can corroborate his observations. It is nearly two years since I noted this fact in a species of *Polyrachis*, which makes its papery nests on the under side of bamboo leaves. The noise, resembling very heavily-falling rain, is caused by the insect striking the leaf by a series of spasmodic taps, both with its head and with the extremity of its abdomen, which it *inflexes* while so doing.

I came on a second large brown species in September last in Sumatra. The noise which, as in the case of the *Polyrachis*, resembled heavy rain, could be heard a long distance off. What struck me most about this species was the singular synchronism of the movements. These ants were spread over a space perhaps a couple of yards in diameter on the stem, leaves, and branches of a great tree which had fallen, and not within sight of each other; yet the tapping was set up at the same moment, continued exactly the same space of time, and stopped at the same instant; after the lapse of a few seconds all recommenced at the same instant. The interval was always of about the same duration, though I did not time it; each ant did not, however, beat synchronously with every other in the congeries nearest to me; there were independent tappings, so that a sort of tune was played, each congeries dotting out its own music, yet the beginnings and endings of these musical parties were strictly synchronous.

HENRY O. FORBES

Sumatra, April

The Pitt-Rivers Collection: Bell-Clappers—the Tooth-Ornament

IN the account lately given in your columns of the Pitt-Rivers Anthropological Collection I find it stated, in speaking of bells: "The clapper is a late addition to the bell which does not exist in Japan or China." When in West Java a year ago I saw in the possession of a gentleman there a bronze (?) bell dug up on the site of one of the old Hindoo settlements, of which now only the graves remain. It had lost the clapper, but the hook, to which I have no doubt a clapper originally was attached, existed still. The form of the bell was much like those figured by Raffles in his "History of Java."

In speaking also of the development of ornamentation reference is made to the W pattern. In the Lampongs this is the most common and almost the only ornamentation. Its origin may possibly be as Mr. Low suggests; but farther up the country, where adornment is more frequent and varied, I find a very common pattern to be a circle ornamented all round the circumference with this toothed design, evidently, I think, representing the sun, and it is not improbable that on the circle being dropped where it could not well be introduced the "tooth-ornament" alone was retained.

Once travelling near Lake Doon, in the West of Scotland, I entered a lonely hut amid the mountains, where a woman was washing the floor—at least the stones set in it, for they were let into the mud at considerable distances apart. As she finished each stone she ornamented it with a piece of pipeclay with concentric circles, combining, where the stone was larger, two of these concentric ornaments into one by a stalk—as of a stem with two flowers on it  . Did she still unwittingly retain the ornamentation of the European Bronze Period?

Sumatra, April

HENRY O. FORBES

ON TOTAL SOLAR ECLIPSES OCCURRING BEFORE THE END OF THE PRESENT CENTURY

AT various times during the last six years we have given in our "Astronomical Column" particulars (including elements) of most of the total eclipses of the sun that will happen before the close of the nineteenth century. As the attention of many astronomers may soon be directed to arrangements for observing the eclipse on May 17th, 1882, we present here, in a collective form, the principal characteristics of such phenomena during the interval in question, which are likely to possess special interest under the circumstances. We shall refer to twelve eclipses, commencing with that of the ensuing year.

(1) 1882, MAY 17.—The most accessible positions on the central line will be in Upper Egypt and the extremity of the peninsula of Sinai about Sherm, but the duration of totality will be greater in the vicinity of Teheran. Where the central eclipse crosses the Nile, totality will commence at about 8h. 33m. a.m. local mean time, continuing 1m. 12s. According to General Stebnitzki's recent determination of the geographical position of the apparatus-room of the Indo-European Telegraph at Teheran, the central line will pass 8′ to the south of it, and here the duration of total eclipse will be 1m. 44s., which may be considered the longest available on this occasion: the sun's altitude will be 67°. The central eclipse passes off the Asiatic coast near Shanghai, running about 18′ north of that place; a direct calculation for Shanghai shows a partial eclipse only, greatest at 5h. 21m. p.m., magnitude 0·996, while at the neighbouring meteorological observatory of Zi-ka-wei, the eclipse is also partial, magnitude 0·994. On the central line in the longitude of Shanghai, the total eclipse continues only 35s. with the sun at an altitude of 18°.

(2) 1883, MAY 6.—In this case we have an eclipse where the totality will extend to nearly six minutes, but unfortunately this long duration falls upon the Pacific Ocean, and it does not appear that there is any land where it can be observed. By the Admiralty chart of the Marquesas, a duration of 2m. 53s. might be available on the Island Fetou-houhou, or Chanel Island, the sun at an altitude of 63°, and totality commencing about 0h. 42m. local mean time. At the head of Anna Maria Bay, Nouka-hiva, there is a partial eclipse only, magnitude 0·97. The central line lies wholly upon the Pacific: greatest duration of total phase 5m. 56s. in about 147° W. and 9° S.

(3) 1885, SEPTEMBER 8.—Observable in New Zealand soon after sunrise. In the longitude of Wellington the duration of totality will be 1m. 55s., with the sun at an altitude of 15°, at Wellington itself the duration will be hardly 40s.; the central line passes some forty-five miles to the north. The greatest eclipse falls in mid-Pacific in 58° S. latitude,

(4) 1886, AUGUST 29.—Totality will continue longer in this eclipse than in any other occurring within the interval which we are considering, but again it will happen that the greatest durations fall on the ocean, in this case upon the Atlantic. At the southern extremity of the Island of Grenada, or in 61° 35′ W. and 11° 59′ S. there will be a total eclipse with the sun at an altitude of nearly 20°, commencing at 7h. 10m. a.m. local mean time and continuing 3m. 15s. In 14° 13′ W. and 2° 58′ S. the sun will be upon the meridian at the middle of the eclipse, and totality will last for 6m. 27s. The central line meets the African coast in about 12° 14′ S. and here the duration of the total phase will be about 4m. 38s., with the sun at an altitude of 39°. [This eclipse is a recurrence of that of 1868, August 18, when the central line passed across Hindostan from near Kolapore to Masulipatam, where the duration of totality was 5m. 45s., but attained a maximum of 6m. 46s. on the west coast of the Gulf of Siam. At its next recurrence, 1904, September 9, the total phase continues 6m. 19s. but in mid-Pacific longitudes a little south of the equator. On September 21, 1922, though there is no land where the totality will be longest, a duration of about 3½ minutes will be available on the east coast of Australia.]

(5) 1887, AUGUST 19.—It was long supposed that the central line in this eclipse would extend to England, but it appears to commence in 11° 39′ E. and 51° 38′ N. It will be most favourably observed in Asiatic Russia, but some fifty miles north of Moscow the total eclipse will continue 2m. 30s. with the sun at an altitude of 17°, and this is perhaps the most westerly station that observers should be induced to fix upon. In Moscow the duration would seem to be about one minute. At Berlin the sun will be totally eclipsed immediately after rising. On Lake Baikal

totality will continue about 3m. 38s., with the sun at an altitude of 50° and near the meridian.

(6) 1889, DECEMBER 22.—The greater duration of totality in this eclipse falls upon the Eastern Atlantic, but where the central line meets the African coast in Angola (about 10° 6′ S.) it continues 3m. 35s., with the sun at an altitude of 56°. At Bridgetown, Barbados, totality commences about 6h. 47m. A.M., with the sun at an elevation of 6°, and continues 1m. 48s.

(7) 1892, APRIL 26.—Almost entirely an ocean track on the South Pacific, commencing indeed in the Antarctic Ocean at a latitude of upwards of 75°: an impracticable eclipse, though the duration of totality attains a maximum of more than four minutes.

(8) 1893, APRIL 16.—Probably, all classes of observation considered, this will be the most favourable eclipse occurring before the end of the century. On the west coast of South America, rather less than a degree north of Coquimbo, where the sun will have attained an altitude of 24°, totality will continue nearly three minutes, commencing about 8h. 14m. a.m.: hence the central line traverses Brazil, passing off the South American continent near Ciara, and here the sun, at an altitude of 77°, and near the meridian, will be totally eclipsed 4m. 44s., or within a second or two of the longest interval possible on this occasion. Perhaps the central eclipse may pass about 10′ north of Ciara. After traversing the Atlantic it enters Africa close to Bathurst, at the mouth of the Gambia, where the total phase still continues about four minutes, thence through Central Africa to a point from 4° to 5° west of Khartoum, where it leaves the earth. From these circumstances an extended course of observations may be expected.

(9) 1894, SEPTEMBER 28.—On this occasion we have either a sea-track or a passage over inaccessible regions, except that the eclipse may ultimately be found to be total in the Seychelles; the tabular position of the moon, upon which our calculations referring to this phenomenon are founded, perhaps admitting of alteration to the amount required. The central line commences in the middle of Africa just north of the equator, leaving that continent near the Juba River, the mouth of which is almost upon the equator. In the longitude of Mahé in the Seychelles it appears to pass about 38′ to the south. The maximum duration of totality occurs in about 86° E. and 34° S., and is close upon two minutes. From this point the course of the central line is in the direction of Macquarie Island, near to which it passes off the earth, without, so far as a preliminary computation enables us to say, certainly encountering land after leaving the African continent.

(10) 1896, AUGUST 9.—Stations will doubtless be found for the observation of this eclipse, as although in the first half of its course, at least, the track lies at considerable northern latitudes, the season of the year is favourable. The central line enters Norway, near Tana in Finmark, and in 28° 46′ E. and 70° 31′ N. the duration of totality is 1m. 43s. with the sun at an altitude of 15°. After rising to a still higher latitude the central eclipse begins to descend, until we find it occurs with the sun on the meridian in about 112° 21′ E. and 65° 38′ N., and the latitude continues to diminish until the total phase leaves the earth. In 136° 21′ E. and 51° 5′ N., near the Amoor River totality continues 2m. 38s. with the sun at an altitude of 46°. The total eclipse may be observed also in the northern parts of Yesso, Japan, but does not afterwards meet land. [This will be a recurrence of the eclipse of 1806, June 16, observed by Bowditch in America, of that of 1842, July 8, well observed in the South of France and in Italy, and of the "Himalaya eclipse" of 1860, July 18, when a numerous party was conveyed to the south-west of Europe in H.M.S. *Himalaya*, there meeting with observers from all parts of the Continent, and unitedly putting upon record important details of the phenomena observed. Its last recurrence was on July 29, 1878, when so good an account of it was given in the United States by American and European astronomers.]

(11) 1898, JANUARY 22.—This eclipse may be well observed in Hindostan, where the central line enters the peninsula in about 73° 25′ E. and 16° 38′ N.; totality will commence at oh. 45m., and continue about 2m. 6s. It commences in Senegambia, and leaves the earth in East Mongolia. Although many observations may probably be made in India, it will be seen that the duration of the total phase is comparatively short.

(12) 1900, MAY 28.—The central line entering upon the earth in the Pacific in 18° N. traverses the south-east portion of the United States, from Louisiana (not far from New Orleans) to Norfolk, on the Atlantic coast, and at the point where it leaves the American continent totality commences about 8h. 47m. a.m., and continues 1m. 40s. with the sun at an altitude of 47°. Crossing the Atlantic, upon which the greatest duration of totality falls, it enters Portugal near Ovan in about 40° 49′ N., and here the total phase continues 1m. 30s., with the sun at an elevation of 42°. The eclipse may be well observed in Portugal and Spain; at Alicante totality lasts 1m. 18s. This eclipse will be a recurrence of that of May, 1882, and the available durations of totality, it will be seen, are about the same on both occasions. In Hallaschka's *Elementa Eclipsium*, by an oversight, this eclipse is represented as broadly annular; the geocentric excess of the moon's semi-diameter over that of the sun will be, however, about 9″

The following table exhibits the approximate positions of beginning and ending of total phase, and of the central eclipse at apparent noon, for the twelve eclipses included in the above remarks:—

Year.	Central Beginning.	Total at Apparent Noon.	Central Ending.
1882...	3°·1 W. 10°·7 N.	63°·8 E. 38°·8 N.	138°·9 E. 25°·5 N
1883...	155°·9 E. 34°·8 S.	147°·2 W. 9°·2 S.	86°·9 W. 13°·6 S.
1885...	156°·9 E. 40°·9 S.	138°·7 W. 57°·7 S.	75°·6 W. 74°·6 S.
1886...	79°·6 W. 9°·9 N.	14°·2 W. 3°·0 N.	47°·3 E. 22°·0 S.
1887...	11°·7 E. 51°·6 N.	102°·3 E. 53°·8 N.	173°·8 E. 24°·5 N.
1889...	78°·9 W. 15°·4 N.	6°·5 W. 11°·1 S.	60°·9 E. 6°·9 N.
1892...	144°·1 W. 76°·1 S.	138°·7 W. 67°·3 S.	81°·7 W. 38°·4 S.
1893...	95°·7 W. 36°·3 S.	36°·6 W. 1°·0 S.	28°·6 E. 16°·4 N.
1894...	26°·9 E. 1°·7 N.	86°·3 E. 34°·3 S.	163°·0 E. 56°·4 S.
1896...	1°·0 W. 63°·5 N.	112°·4 E. 65°·6 N.	179°·1 W. 18°·6 N
1898...	10°·0 E. 11°·0 N.	68°·8 E. 12°·9 N.	119°·3 E. 45°·9 N.
1900...	116°·6 W. 18°·0 N.	44°·8 W. 45°·0 N.	31°·8 E. 25°·4 N.

A CHAPTER IN THE HISTORY OF THE CONIFERÆ[1]

THE CUPRESSINEÆ

THESE are classed as the first tribe of the Coniferæ in Hooker's "Genera Plantarum," wherein seven genera are recognised. The Cupressineæ are large trees or shrubs, very resinous, with small scale-like leaves. The cones are small and globular, and composed of six, eight, or rarely ten peltate and persistent scales, except in the juniper, in which they coalesce into a fleshy galbulus or berry. The seeds are small, compressed, frequently triangulated, and, except in *Juniperus* and the Biota section of *Thuja*, provided with small membranaceous wings at the angles. The order comprises many of the hardiest shrubs in existence.

Their origin can possibly be traced back to the Permian genus *Ulmannia*, and they seem to have become the preponderating tribe during the Jurassic and Wealden, to judge from the prevalence of wood known as Cupressinoxylon. The earlier forms, described as *Widdringtonites*, *Echinostrobus*, *Thuyites*, and *Thuyopsis*, though of great interest are still imperfectly known, even from the Cretaceous, but with the Tertiary period most of the

[1] Continued from vol. xxiii. p. 414.